The Current State-of-the-Practice in Modeling Road Pricing

Bruce D. Spear

Federal Highway Administration

Current Methods for Modeling Road Pricing

1. Mode Choice
   a. Auto sub mode in nested logit model
   b. Toll as generalized cost function variable
   c. Does not directly deal with effects of increasing congestion effects

Current Methods for Modeling Road Pricing

2. Assignment
   a. Use generalized cost to determine shortest path
   b. Toll lanes represented as separate, parallel link with tolls expressed as time penalty.
   c. As congestion increases in parallel links, toll road becomes more attractive.
   d. Requires multi-class assignment models and multiple trip matrices based on value-of-time.

Current Methods for Modeling Road Pricing

3. Diversion Models

   a. Commonly used to forecast toll revenues in investment studies for new roads.

   b. Generally applied after assignment step.

   c. Splits corridor traffic between toll and free road based on empirical data from past toll road studies.

   d. Empirical data is proprietary.

Forecasting Toll Revenues for Investment Risk Studies

- Determine investment risk for new projects where toll revenues repay construction costs.

- Supplemental data collected:
  - Independent analysis of population and employment growth.
  - Additional O-D surveys, traffic counts, and travel time runs in the study corridor.
  - State preference surveys of HH in corridor.

Barriers to Modeling the Travel Demand Impacts of Road Pricing

1. Lack of empirical data on value-of-time (VOT) and how it varies by trip purpose and traveler.

    –   Substantial research on VOT; however:

    –   Past research does not reflect characteristics on new toll facilities:

        ●   HOT lanes,
        ●   Electronic toll collection

Barriers to Modeling the Travel Demand Impacts of Road Pricing

2. Current 4-step models cannot easily analyze the impacts of dynamic tolls.

   – Daily traffic partitioned in coarse time periods (peak, off-peak, etc.)

   – Each period modeled independently

   – No method for spreading demand between time periods.

Barriers to Modeling the Travel Demand Impacts of Road Pricing

3. No data or method for including "reliability" as a variable in travel models.

    – Growing evidence that reliability is key factor in demand for HOT lanes.

    – Lack of empirical data on value of reliability (VOR).

    – Difficulty of measuring reliability as a variance rather than as a mean value.

Recommendations for Improving Current Practice in Modeling Road Pricing

1. Document case studies where transportation planning agencies have incorporated road pricing in their travel demand models.

2. Compile and synthesize current and past empirical research on value of time and value of reliability.

3. Encourage data collection on travel behavior on federally funded road pricing projects.

Recommendations for Improving Current Practice in Modeling Road Pricing

4. Conduct basic and applied research to incorporate time-of-day and peak spreading in current travel demand models.

5. Conduct basic research to better understand and measure the influence of traffic congestion on travel time reliability.